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मानक

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IS 9340 (1993): Expendable pallets [TED 12: Freight Containers and Pallets]



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भारतीय मानक

एक बार उपयोग में आने वाले पैलेट—विशिष्ट

(पहला पुनरीक्षण)

Indian Standard

EXPENDABLE PALLETS—SPECIFICATION

(First Revision)

UDC 621.869.82

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BUREAU OF INDIAN STANDARDS
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August 1993

Price Group 6

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Pallets Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This Indian Standard was first published in 1979. This revision includes the preservative treatment for timber used in pallets and comparative strength coefficient of different species (timber) with respect to teak taken as 100. Also, the colour code to identify the grade of pallets is being included.

Expendable pallets are inexpensive and generally suitable for one time use only. Therefore, material to be used need not be of special selective nature.

Pallets covered by this standard are intended for the use with forklift and handlift trucks for general materials handling operations in storage and distribution systems. They are used to palletise such commodities as bags, bales, barrels, boxes, cartons, cases, drums, kegs, sheeting, tags and wires or other commodities packaged or packed in these containers.

In the preparation of this standard, assistance has been derived from PPP-P-1660A Federal specification pallet — Expendable, issued by the Federal Supply Services of USA.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

EXPENDABLE PALLETS — SPECIFICATION

(First Revision)

1 SCOPE

This standard covers different types of expendable pallets, their dimensions and requirements of materials and construction.

2 REFERENCES

2.1 The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 DEFINITIONS

For the purpose of this standard the definitions as given in IS 3971 : 1976 shall apply.

4 CLASSIFICATION OF PALLETS

Expendable pallets shall be one of the following types, classified by deck, entry and other constructional features.

4.1 Deck

The pallets may be single-deck, double-deck (reversible) or double-deck (non-reversible) type.

4.2 Entry

Pallets may be two-way-entry or four-way-entry type.

4.3 Other Constructional Features

Pallets may be of flush or winged construction.

5 GRADE

5.1 For easy identification of pallets colour code is given below :

<i>Pallets</i>	<i>Colour Code</i>
Grade A	Green
Grade B	Red

6 DIMENSIONS

6.1 Overall Plan Dimensions

6.1.1 The overall plan dimensions of pallets recommended for use in materials handling are as follows, subject to the manufacturing tolerances of ± 5 mm:

<i>Length, mm</i>	<i>Width, mm</i>
800	1 000
1 000	1 200
1 100	1 100
1 200	1 200
1 200	1 800

6.1.2 Dimensions of pallets suitable for movement by rail and road are as follows, subject to manufacturing tolerance of ± 5 mm:

<i>Length, mm</i>	<i>Width, mm</i>
800	690
920	690
1 000	690
1 070	690
1 070	920

6.2 Dimensions of Entry

The dimensions of entry and the maximum under-clearance of the top deck of the pallet shall be as given in Table 1.

6.3 Dimensions of Wings

6.3.1 In a wing pallet, the minimum width of the wing shall be 575 mm for 1 200 x 1 800 mm pallet; and 65 mm for other sizes of pallets.

6.3.2 Entry under wing for wing pallets shall be minimum 70 mm.

6.4 Bearing Surface

In a double-deck pallet the area of the bottom deck shall be not less than 35 percent of the overall area of bearing surface or equal to bearing surface.

6.5 Chamfering

To facilitate easy entry of finger wheels in double-deck restricted entry pallets, the bottom deckboards, if thicker than 15 mm shall be chamfered on each side at an angle of $40^\circ \pm 5^\circ$ to the bottom surface, so that the vertical obstruction to the finger wheels is reduced to a dimension of 10^{+5}_{-0} (see Fig. 1). Chamfer shall not extend beyond the width of entry.

6.6 Dimensions of Deckboards

6.6.1 The minimum width of the edgeboards shall be 150 mm and that of other deckboards 100 mm. However, in double-deck pallets of 800 mm and 1 000 mm sides having bottom deck openings for use with pallet trucks, the width of edgeboards in bottom deck shall be as required to maintain the size of openings. In no case, the width of deckboards shall exceed 200 mm.

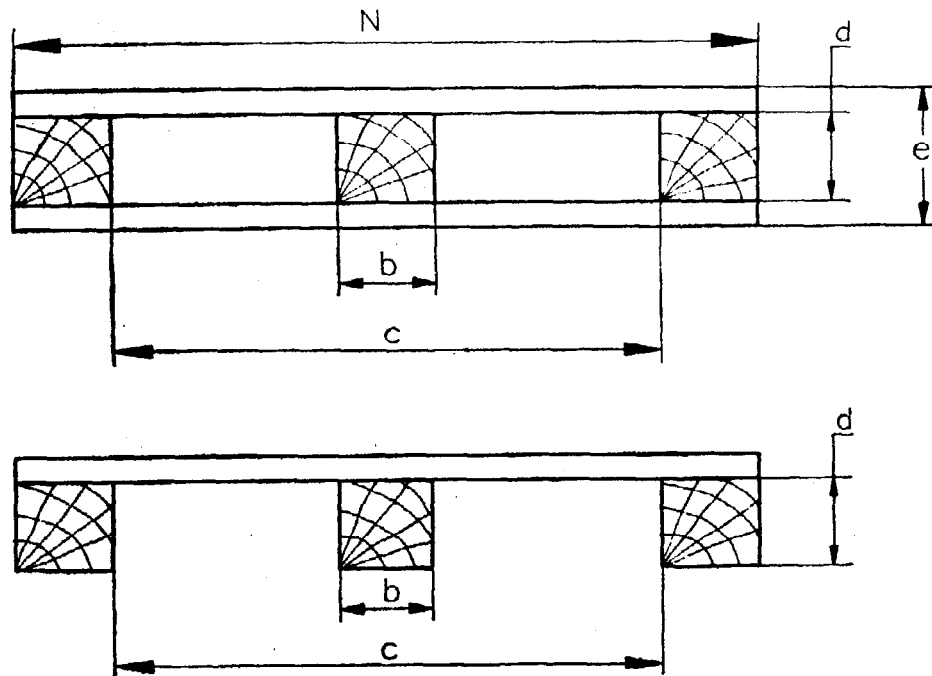
6.6.2 In a double-deck pallet required to be handled by pallet truck the maximum thickness of both bottom and top deckboards shall be minimum 25 mm.

6.7 Opening in Bottom Deck

In a double-deck pallet required to be handled by pallet trucks, openings in the bottom deck shall be provided to allow fingerwheels of pallet truck to maintain contact with the ground both in the raised and lowered positions. This may be done by placing central deckboards within dimension 'B' and edgeboards beyond dimension 'C' from either end of the pallet (see Fig. in Table 2). Dimensions 'B' and 'C' will be as shown in Table 2 in relation to the fork-lengths of pallet trucks to be used with a pallet.

Table 1 Dimensions of Entry
(Clause 6.2)

All dimensions in millimetres.



Nominal Dimension <i>N</i>	<i>b</i> Max	<i>c</i> Min	<i>d</i> Min	<i>e</i> Max
(1)	(2)	(3)	(4)	(5)
800	150	590	75	130
1 000	150	710	75	130
1 100	150	750	75	130
1 200	150	800	75	130
1 800	—	800	75	130

NOTE - Dimensions *b* and *c* are symmetrically disposed about the centre line of the pallet. Their size and position were determined having in mind the use of pallet trucks having fingers of either 570 mm or 690 mm maximum overall width and having a minimum space of 180 mm between fingers (see IS 5007 : 1988). Only pallet trucks having fingers of 570 mm maximum overall width can be used to enter through the 800 mm sides of timber pallets of nominal size 800 x 1 000 mm.

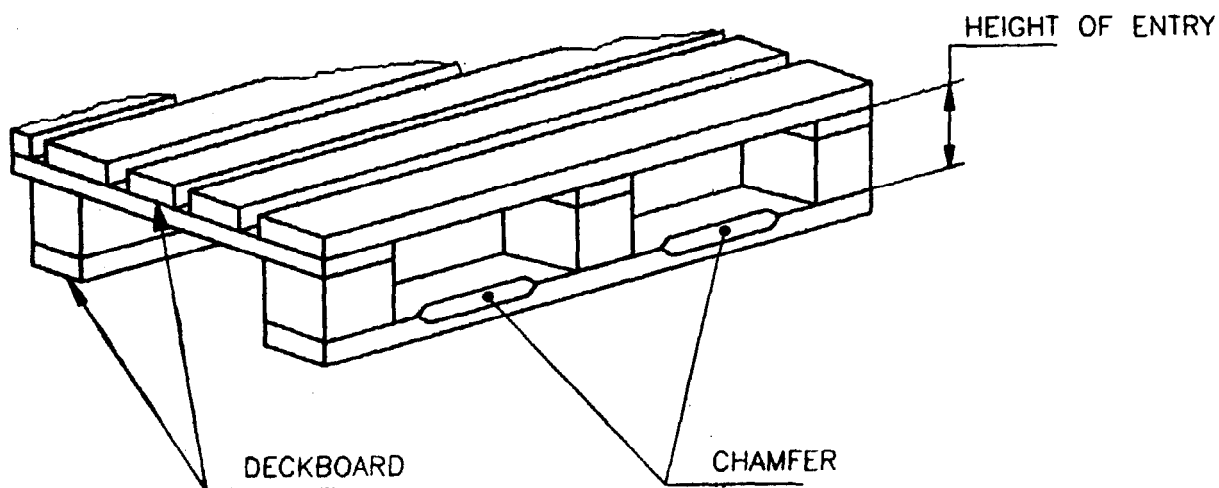
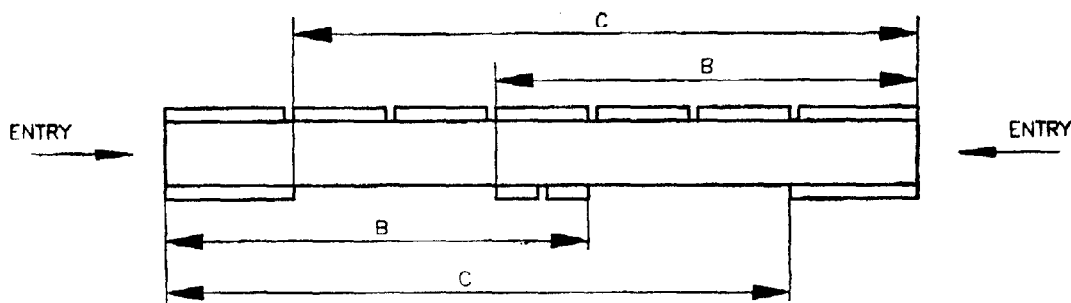


FIG. 1 CHAMFERING

Table 2 Dimensions of Opening in Bottom Deck
(Clause 6.7)

All dimensions in millimetres.



Nominal Pallet Length

Opening Dimensions in Pallet

	For Truck with Twin Tandem Load Wheels		For Trucks with Single Load Wheels	
	<i>B</i> <i>Max</i>	<i>C</i> <i>Min</i>	<i>B</i> <i>Max</i>	<i>C</i> <i>Min</i>
(1)	(2)	(3)	(4)	(5)
(762)	(435)	(660)	(455)	(645)
800	475	700	490	680
(914)	(590)	(810)	(605)	(795)
1 000	615	840	690	880
(1 067)	(680)	(905)	(760)	(950)
1 200	815	1 040	890	1 080
(1 219)	(835)	(1 060)	(910)	(1 100)

NOTES

- 1 A minimum 6 mm clearance has been provided between finger wheels of pallet truck and deckboards in all cases.
- 2 Dimensions in parentheses are based on existing pallet trucks in use.

7 RATING

7.1 The nominal load rating *R* of a pallet shall be 500 kg or 1 000 kg.

8 MATERIAL REQUIREMENTS

8.1 General

The material for the pallet shall be as specified by the purchaser.

8.1.1 If the material is not specified, the manufacturer of the pallet shall choose a suitable material to meet the requirements of rating of the pallet, the nature of the load (see IS 8005 : 1976), load capacity and intended use.

8.1.1.1 The quality and thickness of the material shall be such that the pallet complies with the appropriate requirements of the purchaser and the tests given in 11.

8.2 The materials for pallets shall meet the following additional requirements.

8.2.1 Metal components shall be corrosion-resistant or protected against corrosion to the extent considered good commercial practice.

8.2.2 The outer surface of the deck(s) shall be treated with anti-ship compound or roughened.

8.2.3 Material shall be so chosen as to be suitable for load requirements and design of pallet.

8.2.4 If timber is chosen as a material for the pallet, it shall be any of the species listed in Annex B. The comparative strength coefficient for pallets of different species, with respect to teak taken as 100, are also given in Annex B for general guidance. Any other suitable timber not included in Annex B may also be used with the prior approval of the purchaser.

NOTE - As far as possible only one species of timber shall be used for the manufacture of any one pallet.

8.2.4.1 The timber shall be seasoned and the moisture content shall not exceed $22\% \pm 2$ for grade A pallets and $30\% \pm 2$ for the grade B pallets. The moisture content of timber shall be determined by oven dry method of electrical moisture meter as per IS 11215 : 1985. The defects shall be considered acceptable up to the limits listed in Annex C for the manufacture of pallets. The relevant terms and definitions of timber defects are given in Annex D.

8.3 Preservative Treatment

If required, all timber components shall be given preservative treatment conforming to IS 401 :1982. For pressure treatment following are recommended:

10 WORKMANSHIP

10.1 Workmanship of expendable pallets shall be as specified in Annex E.

Sl. No.	Preservative	Recommended Absorption kg/m ³	Remarks
1.	Copper-Chrome-Arsenic	4	See IS 10013 (Part 2) : 1987
2.	Acid Copper-Chrome	4	See IS 10013 (Part 1) : 1987
3.	Copper-Chrome-Boron	6.5	See IS 10013 (Part 3) : 1981
4.	Penta-Chloro-Phenol	4	See IS 716 : 1970
5.	Copper naphenate/abietate	0.5 (calculated on copper basis)	See IS 1078 : 1987
6.	Zinc naphenate/abietate	0.8 (calculated on zinc basis)	See IS 1078 : 1987

For details of treatment and treatability of different species, reference may be made to IS 401 : 1982.

9 CONSTRUCTION

9.1 Type

The type of the pallet shall be as agreed to between the manufacturer and the purchaser.

9.2 Stability

When placed on a horizontal flat surface, the pallet shall rest evenly and the decks shall be flat and horizontal.

9.3 Assembly

The decks of the pallets shall be parallel to one another. Joining of the components shall be such that the assembly pallet shall meet the test requirements as specified in 11. The ends and the sides shall form right angles ($90 \pm 1^\circ$) to one another.

9.4 Fastening

Nails conforming to IS 723 : 1972 shall be used at all joints of the upper surface and lower surface. The size and number of nails to be used shall suit the sizes of the blocks, stringers, and top or bottom planks, etc.

11 TESTING

11.1 Visual Examination

The end items shall be examined in accordance with the classification of defects given in 8.2.3.

11.2 Conditioning

If a pallet is to be used under abnormal conditions, each test sample shall be exposed to the appropriate condition immediately before it is tested. The length of the exposure shall be long enough to ensure adequate conditioning of the material for the conditions of use expected (see B-1).

11.3 Tests

11.3.1 Deck Deflection Test

The bottom of the top deck of the pallet shall be supported on two rigid arms of width greater than the width of the deck and of 50 mm width (see Fig. 2). The supporting arms shall have no sharp edge. The supports shall be positioned parallel to, and just inside the , outer stringers or blocks.

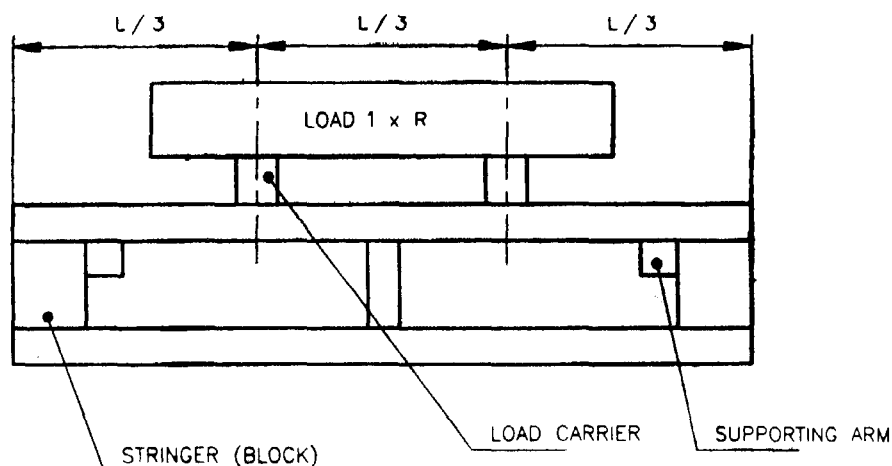


FIG. 2 DEFLECTION TEST

11.3.1.1 In case of wing pallets, the supporting arms shall be positioned parallel to, and just outside the stringers or blocks.

11.3.1.2 The distance from the bottom of the top deck of the pallet to a fixed point of the smooth level floor, when the pallet is horizontal and at the same height from level floor, shall be measured. This height may be designated as A1.

11.3.1.3 Two load-bearing members, as shown in Fig. 3, shall be placed on top of the deck parallel to the support arms and so positioned that they divide the deck into three equal parts. Load shall be applied gradually, evenly distributed on the load-bearing member equals R.

11.3.2.2 The load shall be removed and permanent deformation, if any, measured. This procedure shall be repeated on the same pallet.

11.3.2.3 Requirements

A pallet if made from paper products, shall be considered to have failed if at any time during the test, the deformation exceeds 10 percent of the original dimension. A pallet when made from materials other than paper products shall be considered to have failed if at any time during the test the deformation exceeds 5 percent of the original dimensions.

11.3.3 Rigidity Drop Test

The pallet shall be modified by temporarily affixing

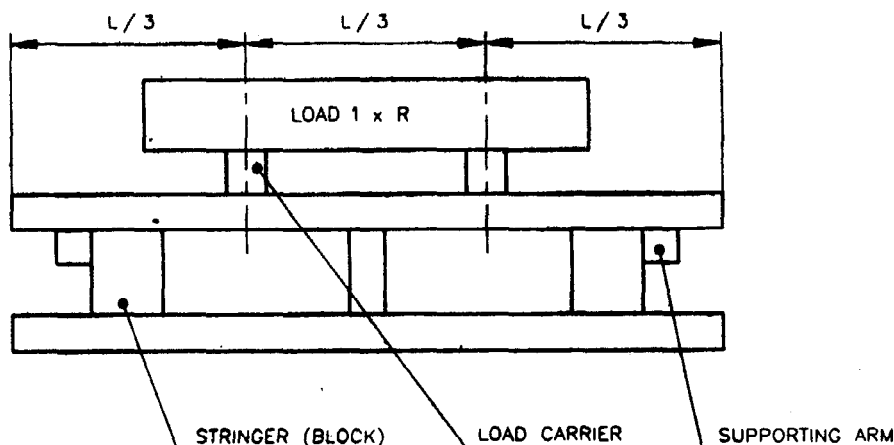


FIG. 3 DEFLECTION TEST (WING CONSTRUCTION)

11.3.1.4 The clearance below the centre of the pallet shall be measured again and designated as A2.

11.3.1.5 The load shall be raised from the pallet and re-applied gradually on the load-bearing member. The clearance below the pallet shall be re-measured and designated as A3.

11.3.1.6 In the case of a 4-way entry pallet the test shall be repeated with the support and load bearers at right angles to the directions used in the first part of the tests.

11.3.1.7 Requirements

The pallet shall have failed if any of the values A1 minus A2 or A1 minus A3 is greater than 1.8 percent of the distance between centres of the supporting arms.

11.3.2 Resistance to Full Deck Load

The pallet shall be placed on a flat horizontal surface and the top deck covered with a steel plate 3 mm thick and of a size to cover the deck completely with a maximum length or width tolerance of + 2 percent.

11.3.2.1 Load shall be applied gradually over the surface of the plate until the sum of the load and the mass of the plate is equal to 5R. Deformation, if any, shall be measured after five minutes.

two pieces of timber underneath the top deck wings. The size of these pieces should be equal to the length of stringers, width of the wings and height of stringers. A pallet shall be suspended so that one of the diagonals of the top deck is vertical and the lowest point of the pallet is 250 mm above a flat, hard and even horizontal surface (metal or concrete). The pallet shall be dropped freely avoiding a flat fall. The drop shall be made in such a manner as to reduce secondary impacts.

11.3.3.1 The pallet shall be suspended as above by a corner of the top deck adjustment to the first corner used and the drop shall be repeated. The same test shall be repeated by suspending a pallet from the corner opposite to the first corner and again by suspending it from the fourth corner.

11.3.3.2 Requirements

The pallet shall be considered to have passed the test if:

- no member is broken and no joint or fastener has failed. Local deformation and split at the corners that occur within 50 mm of a corner shall be ignored.
- the maximum change in the length of the diagonal alternate to that joining the corner of

the suspension and impact shall not, after the test, exceed 3.5 percent of its original length.

11.3.4 Resistance to Impact Test

The pallet shall be placed on a solid flat horizontal surface. The top deck of the pallet shall be covered with a steel plate (see 11.3.2) the load shall be applied gradually and evenly distributed over the surface of the plate until the sum of the load and the weight of the pallet is equal to $1.25 R$. Keeping one edge of the pallet in contact with the solid surface, the opposite edge shall be lifted by means of a bar sling and quick release hook as shown in Fig. 4, so that the whole pallet except one edge is lifted off the solid surface. The free edge which is lifted, and which is opposite to the edge, which is in contact with the solid surface must be lifted to a height of 150 mm, from the solid surface. The free edge which is lifted, and which is opposite to the edge, which is in

contact with the solid surface must be lifted to a height of 150 mm, from the solid surface. The hook shall be then released and the pallet be permitted to fall freely on the solid surface. The load shall be re-adjusted, if necessary, so that it is again evenly distributed on the top deck. The pallet shall then be rotated through an angle of 90° and the test repeated lifting an edge that is adjusted to the edge first lifted.

11.3.4.1 Requirements

The pallet shall be considered to have failed if any deformation, that has occurred, exceeds 5 percent of the original dimension or if any member is found broken or if any joint or fastener has failed.

12 MARKING

12.1 Certification Marking

Details are available with the Bureau of Indian Standards.

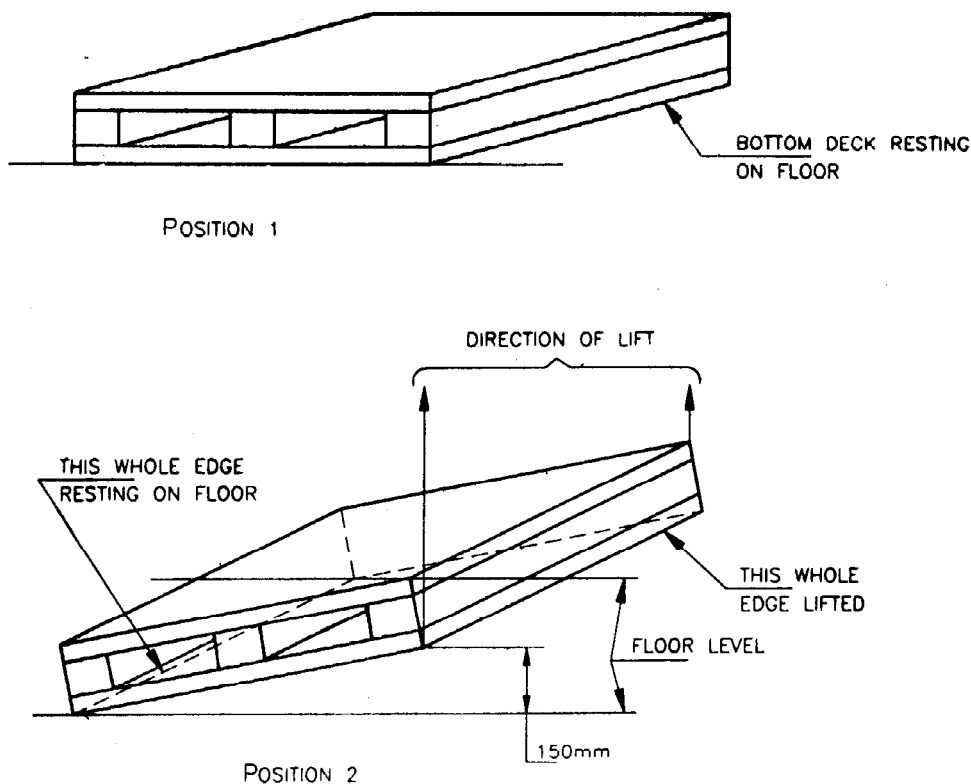


FIG. 4 RESISTANCE TO IMPACT TEST

ANNEX A (Clause 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
399 : 1963	Classification of commercial timbers and their zonal distribution (revised)	401 : 1982	Code of practice for preservation of timber (third revision)

IS No.	Title	IS No.	Title
716 : 1987	Pentachlorophenol (second revision)	10013 (Part 1) : 1981	Specification for water soluble type wood preservatives : Part 1 Acid-copper-chrome (ACC) preservative
723 : 1972	Steel countersunk head wire nails (second revision)	10013 (Part 2) : 1981	Specification for water soluble type wood preservatives: Part 2 Copper-Chrome-arsenic (CCA) wood preservative
1078 : 1987	Copper naphthenate (second revision)	10013 (Part 3) : 1981	Specification for water soluble type wood preservatives: Part 3 Copper-chrome-boron (CCB) wood preservative
3971 : 1976	Glossary of terms (under revision)	11215 : 1985	Methods for determination of moisture content of timber and timber products
5007:1988	Dimensions of pallet trucks (first revision)		
8005 : 1976	Classification of unit loads		

ANNEX B

(Clause 8.2.4)

LIST OF TIMBER SPECIES

Sl No.	Timber Species	Trade Name	Comparative Strength Coefficient for Pallet with Respect to Teak Taken as 100
(1)	(2)	(3)	(4)
1.	<i>Acacia leucophlaea</i> Willd	hiwar	94
2.	<i>Acacia nilotica</i> Del (A. arabica Willd)	babul	113
3.	<i>Acacia tortilis</i>		101
4.	<i>Acrocarpus fraxinifolius</i> W. & A.	mundani	99
5.	<i>Adina cordifolia</i> Hook.f.	haldu	76
6.	<i>Albizia lebbek</i> Benth	kokko	86
7.	<i>Albizia odoratissima</i> Benth	kala-siris	123
8.	<i>Albizia procera</i> Benth	safed-siris	98
9.	<i>Altingia excelsa</i> Noronha	jutili	102
10.	<i>Amoora</i> spp.	amari	93
11.	<i>Anogeissus latifolia</i> Bedd.	axlewood	117
12.	<i>Aphanamixis polystachya</i> Parker	pitraj	98
13.	<i>Artocarpus heterophyllus</i> Lam.	kathal	83
14.	<i>Artocarpus hirsutus</i> Lam.	aini	84
15.	<i>Artocarpus lakoocha</i> Roxb.	lakooch	78
16.	<i>Azadirachta indica</i> A.Juss.	neem	103
17.	<i>Bridelia</i> spp.	kassi	80
18.	<i>Calophyllum</i> spp.	poon	95
19.	<i>Canarium strictum</i> Roxb.	white dhup	83
20.	<i>Careya arborea</i> Roxb.	kumbi	118
21.	<i>Cedrus deodara</i> G. Don. f.	deodar	75
22.	<i>Chukrasia velutina</i> W. & A.	chickrassy	86
23.	<i>Chloroxylon swietenia</i> DC	satinwood	105
24.	<i>Cullenia rosayroana</i> Kostermans	karani	89
25.	<i>Dalbergia sissoo</i> Roxb	sissoo	107
26.	<i>Dillenia</i> spp.	dillenia	75
27.	<i>Diospyros</i> spp.	ebony	101
28.	<i>Dipterocarpus macrocarpus</i> vesque	hollong	99
29.	<i>Dipterocarpus</i> spp.	gurjan	91

Sl No.	Timber Species	Trade Name	Comparative Strength Coefficient for Pallet with Respect to Teak Taken as 100
(1)	(2)	(3)	(4)
30.	<i>Dysoxylum malabaricum</i> Bedd.	white cedar	96
31.	<i>Exbucklandia populnea</i> R. W. Brown	pipli	86
32.	<i>Gardenia</i> spp.	gardenia	86
33.	<i>Garuga pinnata</i> Roxb.	garuga	74
34.	<i>Grewia tiliifolia</i> Vahl	dhaman	119
35.	<i>Hardwickia binata</i> Roxb.	anjan	103
36.	<i>Lagerstroemia hypoleuca</i> kurz	pyinma	77
37.	<i>Lagerstroemia lanceolata</i> wall.	benteak	93
38.	<i>Lagerstroemia parviflora</i> Roxb.	lendi	98
39.	<i>Lagerstroemia speciosa</i> Pers.	jarul	83
40.	<i>Machilus</i> spp.	machilus	77
41.	<i>Madhuca longifolia</i> Mac Bride	mahua	98
42.	<i>Mangifera indica</i> Linn.	mango	82
43.	<i>Mitragyna parvifolia</i> Korth	kaim	80
44.	<i>Ougeinia oojeinensis</i> Hochreut	sandan	97
45.	<i>Palaquium ellipticum</i> Engler	pali	90
46.	<i>Prosopis juliflora</i>	-	130
47.	<i>Prosopis cineraria</i> Druce	jband	116
48.	<i>Pterocarpus marsupium</i> Roxb.	bijasal	106
49.	<i>Pterospermum acerifolium</i> Willd.	hatbipaila	91
50.	<i>Quercus</i> spp	Indian oaks	114
51.	<i>Schima wallichii</i> Korth	chilauni	86
52.	<i>Shorea robusta</i> Gaertn.f.	sal	121
53.	<i>Stereospermum</i> spp.	padri	97
54.	<i>Syzygium</i> spp.	jaman	102
55.	<i>Tamarindus indica</i> Linn	imli	110
56.	<i>Tamarix articulata</i> vahl	frash	81
57.	<i>Terminalia alata</i> Roth	laurel	109
58.	<i>Terminalia arjuna</i> W. & A.	arjun	72
59.	<i>Terminalia bellirica</i> Roxb.	bahera	101
60.	<i>Terminalia bialata</i> Kurz (sapwood)	white chuglam	117
61.	<i>Terminalia chebula</i> Retz.	myrabolan	117
62.	<i>Terminalia manii</i> King	black chuglam	102
63.	<i>Terminalia myriocarpa</i> Hcurck & Muill. — Arg	hollock	75
64.	<i>Terminalia paniculata</i> Roth	kindal	90
65.	<i>Terminalia procera</i> Roxb.	white bombwe	79
66.	<i>Xylia xylocarpa</i> Taub.	irul	105
67.	<i>Zanthoxylum rhetsa</i> DC	mullilam	107
68.	<i>Albizia procera</i> Benth	safed siris	88
69.	<i>Albizia Odoratissima</i> Benth	kala siris	124

ANNEX C
(Clause 8.2.4.1)

TIMBER DEFECTS FOR EXPENDABLE PALLETS

<i>Sl No.</i>	<i>Defects</i>	<i>Permitted Limitations of Defects</i>
1.	Cross grains	Slope of grain not to exceed 1 in 4 of length in endboards, stringer, boards, outside stringers and blocks. Unlimited in centre stringers and inside boards.
2.	Knots: Size, location and number	Average diameter of any knot not to exceed 50 percent of the nominal width of the piece. Sound knots permitted in fastening area without compensating fasteners. Not more than 3 maximum size knots or their equivalent in and 150 mm length of a component. Additional such knots shall be separated by at least 100 mm. Loose and decayed knots permitted, provided these shall be completely bored or cut out and tightly plugged with crossgained seasoned timber being of the same species of timber and properly glued, so that its grains run in the direction of the main piece.
3.	Checks	No limitation in quantity or length of checks in any piece. Checks in blocks that expose screw, nail or fastener shanks are not permitted.
4.	Splits and shakes : Size, location and number	Length of crack or grain separation shall be no longer than the width of the piece in edgeboards and blocks and no longer than three times the width of the piece in stringers, stringerboards and inside boards. Splits running through full thickness of the piece (other than fastener splits) in inside boards are allowed if straddled by fasteners splits in end of outside stringers or blocks are permitted if compensated for by adequate corrugated fasteners driven at right angles across the split. Shake are permitted in any piece if contained by fastening.
5.	Warp	Deviation due to warp in any component of a pallet shall not exceed bow 4 percent, crook 4 percent and cup 6 percent of its measured dimensions.
6.	Wane : Size, location and number	50 percent of width, 75 percent of thickness and unlimited length. No fastener to be driven into or through a wane. Not more than 50 percent of the total parts of a pallet may contain wane.
7.	Decay	Not permitted.
8.	Stain	Permitted.

ANNEX D

(Clause 8.2.4.1)

DEFINITIONS OF TIMBER DEFECTS

D-1 DEFINITIONS

D-1.1 Cross Grain

Grains not parallel to the length of the piece, either diagonal or spiral or a combination of the two (*see* Fig. 5).

D-1.2 Knots

A branch base or limb embedded in the tree or timber by natural growth (*see* Fig. 6).

D-1.3 Loose or Decayed Knot

A knot that will drop out leaving a hole, or due to advanced decay has not structural strength.

D-1.4 Sound Knot

A knot which is solid across its face and at least as hard as the surrounding wood and with no indication of decay. Size of the knot is always measured by its greatest dimension along the width of the piece.

D-1.5 Check

A separation of fibres along the grain which is confined to one face of a piece of wood (*see* Fig. 7).

D-1.6 Split

A separation of fibre which extends from one face of a piece of wood to another and runs along the grain of the piece (*see* Fig. 7).

D-1.7 Shakes

Longitudinal cracks generally between annular rings

that extend lengthwise beyond the visible opening (*see* Fig. 7).

D-1.8 Warp

Any deviation in sawn timber from a true plane surface.

D-1.8.1 Bow

Deviation along the face in the direction of length of piece (*see* Fig. 5).

D-1.8.2 Crook

Deviation edge-wise from a straight line from end to end of a piece (*see* Fig. 5).

D-1.8.3 Cup

Deviation across the grain or width of a piece (*see* Fig. 8).

D-1.9 Wane

Bark or lack of wood on bark (*see* Fig. 6).

D-1.10 Decay

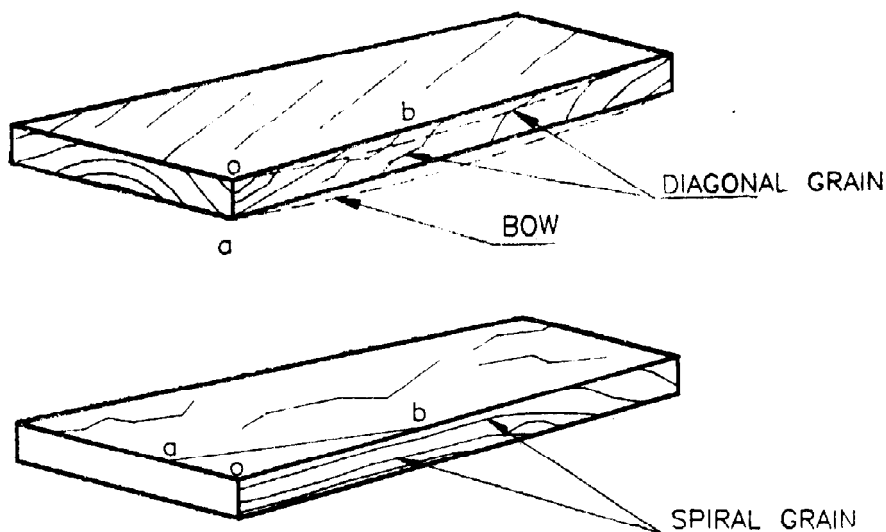
Disintegration of wood substance through the action of wood-destroying fungi.

D-1.11 Stain

Discolouration of wood. It is different from decay.

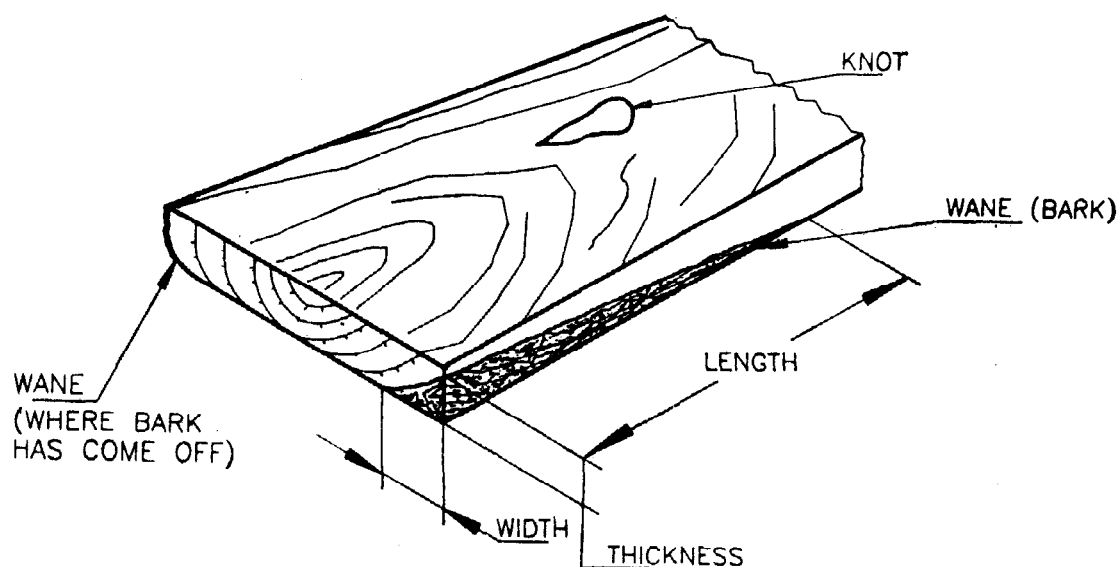
D-1.12 Skip

Area where planer knife fails to touch.



NOTE — Slope of grain is expressed as the ratio $oa : ob$. Small local deviations are usually disregarded in determining the grain direction ab .

FIG. 5 DIAGONAL GRAIN AND SPIRAL GRAIN



NOTE — Knots are measured across width only.

FIG. 6 KNOTS AND WANES

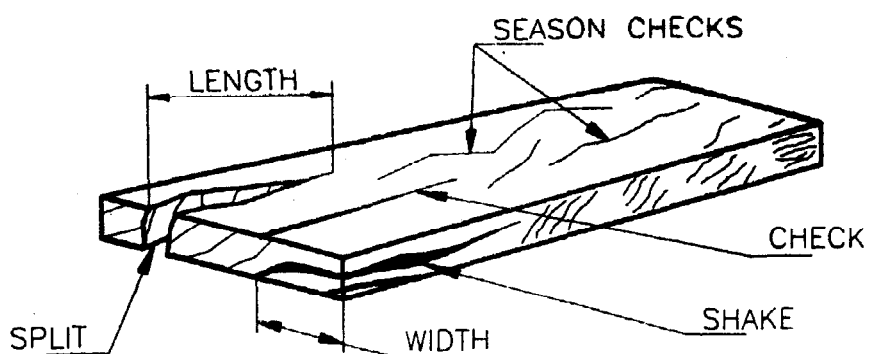


FIG. 7 CHECKS, SPLITS AND SHAKES

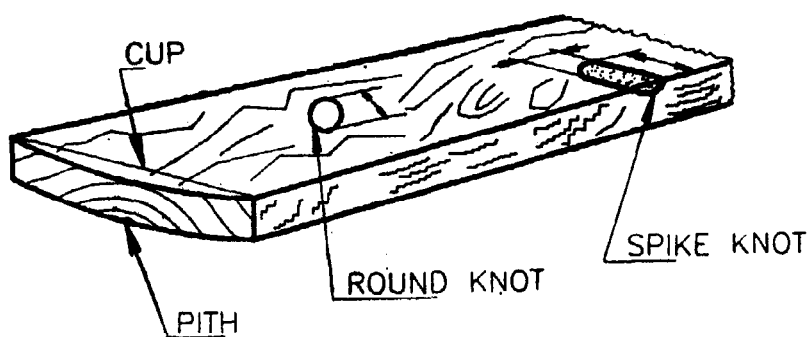


FIG. 8 CUP, ROUNDS AND SPIKE KNOTS IN WOOD BOARD

ANNEX E
(Clause 10.1)

WORKMANSHIP FOR EXPENDABLE TIMBER PALLET'S

<i>Sl No.</i>	<i>Defects</i>	<i>Permitted Limitations</i>
1.	Dimensions of components	Deviation tolerance of each piece from specified nominal (before surfacing) are given below : Length ± 5 mm Width ± 5 mm Thickness ± 3 mm
2.	Surfacing	Deckboards and stringerboards shall be surfaced two sides in width and one side in thickness with surfaced face to be exposed face surfacing tolerance 3 mm for thickness and 9 mm for width. Stringers and blocks shall be surfaced to two sides to uniform height surfacing tolerance 9 mm.
3.	Skip dressing	Shallow skips shall be permitted on blocks, shallow skips shall also be allowed on 50 percent of the other pieces subject to the area being limited to 20 percent of the area of the piece in which it occurs.
4.	Cross cutting	Beared ends not permitted. Deviation for square cut ends permitted on not more than 3 inside boards and 2 stringer or stringerboards provided no ends protrude more than 5 mm beyond face of stringer, stringer-board or block or beyond outer edge of edgeboards.
5.	Deckboard spacing	Maximum toleration plus 6 mm in each case. No limitation on number of spaces.
6.	Parallelism of deviation deck boards	Within 50 percent in any one space, limited to no more than 5 such spaces per pallet.
7.	Fastener splits	Hairline splits permitted up to 50 percent of the total fasteners applied on all pieces if on edgeboards, compensating fasteners are to be provided. Open splits permitted on ends provided they are compensated by additional fasteners.
8.	Protruding fastener heads and points	Not permitted.
9.	Dimensions of assembled pallet	Out of square deviation 12 mm (22 mm difference in diagonals). Overall length and width deviation ± 10 mm.

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